Final Evaluation of Project Delivery Options
Honolulu High-Capacity Transit Corridor Project

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TABLE OF CONTENTS

List of Figures

List of Tables

Summary

This report presents a comparison of project delivery options for the Honolulu High-Capacity Transit Corridor Study (HHCT). It identifies a range of potential project delivery options and initially screens them in terms of applicability for the project's remaining technologies and the project size. The remaining delivery options are then evaluated against a set of detailed evaluation criteria.

Initial Identification and Screening of Delivery Options

A full range of potential project delivery options are identified and described in Chapter 3 of the report and include:

- Design-Bid-Build (DDB)
- Design-Build (DB)
- Design-Build-Operate-Maintain (DBOM)
- Split DBOM System and DB Facilities
- Split DBOM System and DBB Facilities

An initial screening of the five project delivery options found that DB and DBOM, where all elements of a project phase are put out to bid in a single package, did not merit further consideration due to bonding/ insurance difficulties for a single contractor (team) for a project of this magnitude. Conversely, it was determined that if an initial short phase was desired, then DB would be most appropriate. Later larger phases would then transition to one of the remaining three delivery options (DBB or one of the "split" options).

Project Delivery Evaluation

The remaining three delivery options for larger phases are evaluated against a detailed set of evaluation criteria in Chapter 4. Separate evaluations were performed against three types of transit technologies (varying degrees of proprietary design). The findings of these evaluations are summarized as follows:

- No single project delivery option emerges as superior for all types of transit technology.

- Design-Build is the preferred project delivery option if an initial (short) phase is desired. This would not preclude the City from using a different delivery option for latter (longer) phases.

- Design-Bid-Build scored highest for non-proprietary technologies (Light Rail and Rapid Rail) followed closely by Split DBOM System and DBB Facilities.

- Split DBOM System and DBB Facilities scored highest for both semi-proprietary (People Movers and automated Rapid Rail) and full-proprietary (Monorail and

Maglev). Split DBOM/DBB is most appropriate with multiple technologies competing against each other as the City has expressed a desire for.

- Split DBOM Systems and DB Facilities did not score well, relatively or absolutely, for the transit technologies and is eliminated from further consideration.

A potential form of public/private participation in the project is joint development in and around stations. This can be accomplished through any of the remaining delivery options.

A key issue in selecting a delivery option for the HHCT project is to identify the City's desired level of design control and project risks for various aspects of the project. The project delivery option that most closely matches with the City's desired levels of control and risk, and allows for the desired range of technologies, is the most appropriate option.

A number of issues have not yet been finalized on the HHCT project such as project phasing and project technology. These issues impact the decision on the project delivery option and therefore this report has findings based on different phasing and technology choices. These findings are summarized below as well as in Table S-1 on the following page:

- Phasing
    - A short, initial phase would best be delivered via the Design-Build option.
    - A single (large) project or longer phases would best be delivered via DBB or a Split DBOM/DBB option.

- Technology - the City has expressed a desire for range of technologies to compete against each other, therefore, the Split DBOM/DBB is the best option.

Table S-1. Project Delivery Finding

	DBB	DB	DBOM	Split DBOM DB	Split DBOM DBB
	1	2	3	4	5
Initial Screening Criteria					
Technologies	✓	✓	✓	✓	✓
Large Project / Phase	✓	✗	✗	✓	✓
Small Initial Phase	✗	✔	✓	✗	✗
Detailed Evaluation					
Non Proprietary Tech	✔	NA	NA	✗	✓
Proprietary Tech	NA	NA	NA	✓	✔

Key: ✔ = most appropriate ✗ = inappropriate

✓ = appropriate NA = not applicable

Chapter 1 Introduction

The City and County of Honolulu Department of Transportation Services (DTS), in coordination with the U.S. Department of Transportation Federal Transit Administration (FTA), will be preparing an Alternatives Analysis (AA) and an Environmental Impact Statement (EIS) to evaluate alternatives that would provide high-capacity transit service on Oahu. The primary project study area is the travel corridor between Kapolei and the University of Hawaii at Manoa (Figure 1-1). This corridor includes the majority of housing and employment on Oahu. The east-west length of the corridor is approximately 23 miles. The north-south width of the corridor is at most four miles, as much of the corridor is bounded by the Koolau and Waianae Mountain Ranges to the north and the Pacific Ocean to the south.

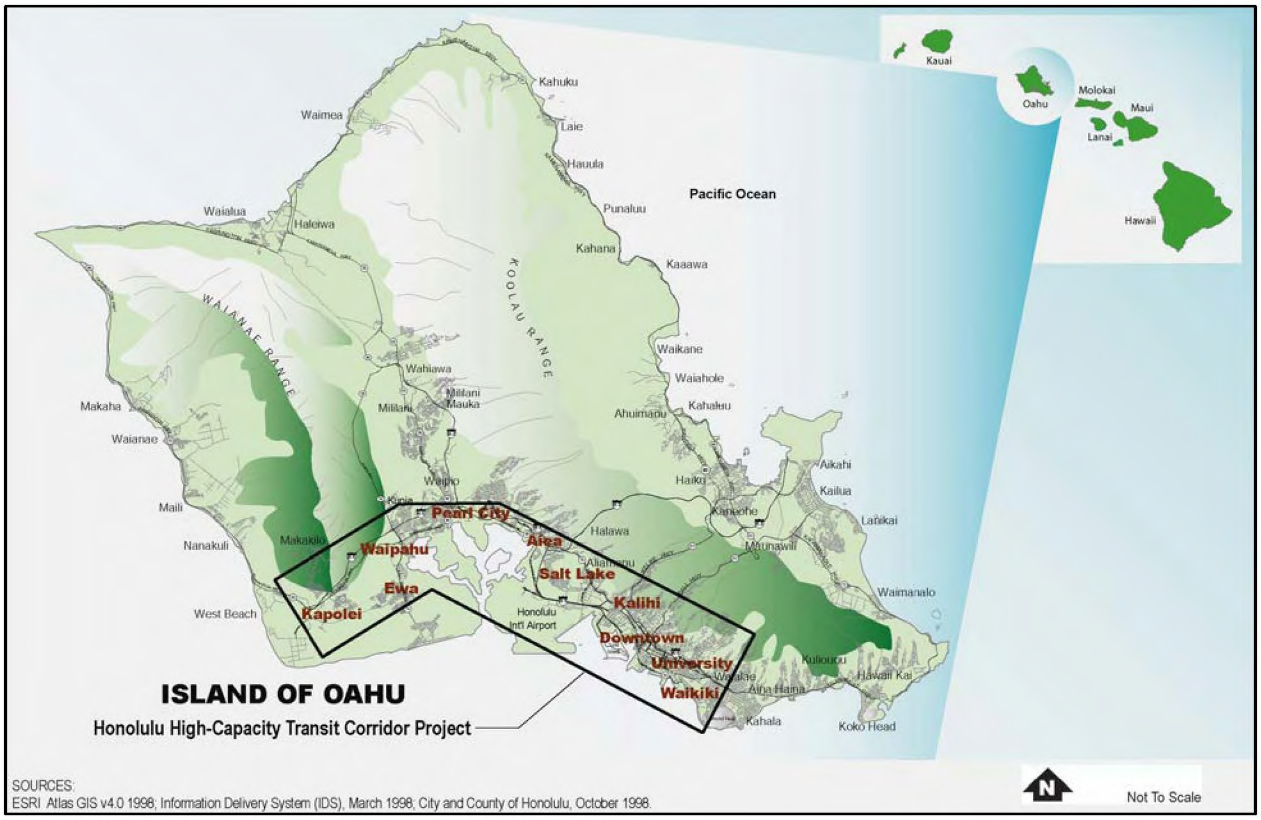


Figure 1-1. Project Vicinity

Project Description

Description of the Study Corridor

The study corridor extends from Kapolei in the west (Waianae or Ewa direction) to the University of Hawaii at Manoa in the east (Koko Head direction), and is confined by the Waianae and Koolau mountain ranges to the north (mauka direction) and the ocean to the south (makai direction).

The corridor is constrained geographically to a narrow band between the mountains and ocean. In the Pearl City, Waimalu, and Aiea area, the corridor's width is less than one mile between the Pacific Ocean and the base of the Koolau Mountains.

The General Plan for the City and County of Honolulu directs future population and employment growth to the Ewa, Central Oahu, and Primary Urban Center development plan areas, with the highest rate of growth in the Ewa area. The largest increases in population and employment are projected in the Ewa, Waipahu, Downtown, and Kakaako districts, which are all located in the corridor (Figure 1-2).

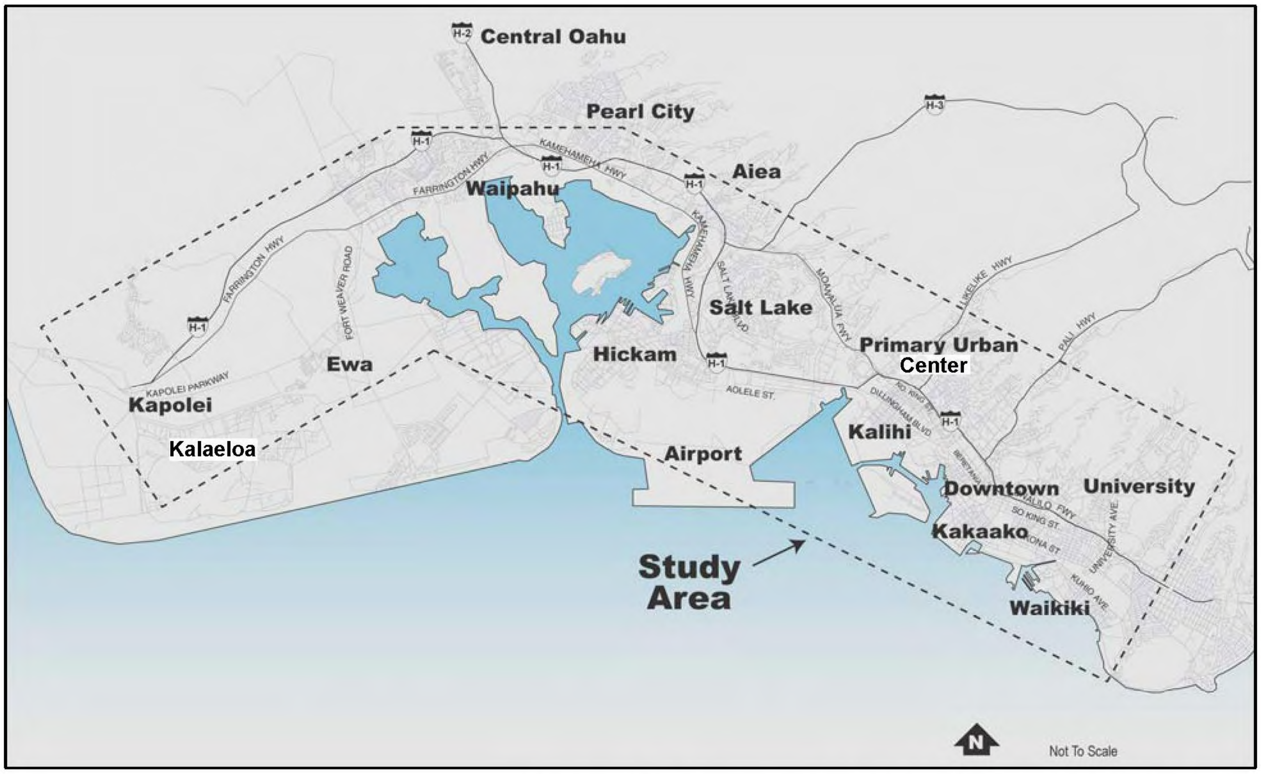


Figure 1-2. Areas and Districts in the Study Corridor

Alternatives under Consideration

Four alternatives will be evaluated in the Alternatives Analysis (AA) report. They were developed through a screening process that considered alternatives identified through previous transit studies, a field review of the study corridor, an analysis of current housing and employment data for the corridor, a literature review of technology modes, work completed by the Oahu Metropolitan Planning Organization (OMPO) for its Draft 2030 Regional Transportation Plan, and public and agency comments received during a formal project scoping process held in accordance with requirements of the National Environmental Policy Act (NEPA) and the Hawaii EIS Law (Chapter 343). The four alternatives are described in detail in the *Honolulu High-Capacity Transit Corridor*

Project Alternatives Analysis Definition of Alternatives Report (DTS, 2006a). The alternatives identified for evaluation in the AA report are:

- No Build Alternative
- Transportation System Management Alternative
- Managed Lane Alternative
- Fixed Guideway Alternative

Alternative 1: No Build Alternative

The No Build Alternative includes existing transit and highway facilities and committed transportation projects anticipated to be operational by 2030. Committed transportation projects are those programmed in the Oahu 2030 Regional Transportation Plan prepared by OMPO. The committed highway elements of the No Build Alternative will also be included in the build alternatives (discussed below).

The No Build Alternative's transit component would include an increase in fleet size to accommodate growth in population, while allowing service frequencies to remain the same as today. The specific number of buses, as well as required ancillary facilities, will be determined during the preparation of the AA.

Alternative 2: TSM Alternative

The Transportation System Management (TSM) Alternative would provide an enhanced bus system based on a hub-and-spoke route network, conversion of the present morning peak-hour-only zipper-lane to both a morning and afternoon peak-hour zipper-lane operation, and relatively low-cost capital improvements on selected roadway facilities to give priority to buses. The TSM Alternative will include the same committed highway projects as assumed for the No Build Alternative.

Alternative 3: Managed Lane Alternative

The Managed Lane Alternative would include construction of a two-lane, grade-separated facility between Waipahu and Downtown Honolulu for use by buses, para-transit vehicles, and vanpool vehicles. High-occupancy vehicles (HOV) and toll-paying, single-occupant vehicles also would be allowed to use the facility provided that sufficient capacity would be available to maintain free-flow speeds for buses and the above noted paratransit and vanpool vehicles. Variable pricing strategies for single-occupant vehicles would be implemented to ensure free-flow speeds for high-occupancy vehicles.

Intermediate bus access points would be provided in the vicinity of Aloha Stadium and Middle Street. Bus service utilizing the managed lane facility would be restructured and enhanced, providing additional service between Kapolei and other points Ewa of the Primary Urban Center, and downtown Honolulu and the University of Hawaii at Manoa.

Alternative 4: Fixed Guideway Alternative

The Fixed Guideway Alternative would include the construction and operation of a fixed-guideway transit system between Kapolei and the University of Hawaii at Manoa. The system could use any fixed-guideway transit technology approved by FTA and meeting performance requirements, and could be automated or employ drivers.

Station and supporting facility locations are currently being identified and would include a vehicle maintenance facility and park-and-ride lots. Bus service would be reconfigured to bring riders on local buses to nearby fixed-guideway transit stations.

Although this alternative would be designed to be within existing street or highway rights-of-way as much as possible, property acquisition in various locations is expected. Future extensions of the system to Central Oahu, East Honolulu or within the corridor are possible, but are not being addressed in detail at present.

A broad range of modal technologies were considered for application to the Fixed Guideway Alternative, including light rail transit, personal rapid transit, automated people mover, monorail, magnetic levitation (maglev), commuter rail, and emerging technologies still in the developmental stage. Several technologies were selected in an earlier screening process and will be considered as possible options for the fixed-guideway technology. Technologies that were not carried forward from the screening process include personal rapid transit, commuter rail, and the emerging technologies. The screening process is documented in the *Honolulu High-Capacity Transit Corridor Project Screening Report* (DTS, 2006b).

The study corridor for the Fixed Guideway Alternative will be evaluated in five sections to simplify analysis and impact evaluation in the AA process and report. In general, each alignment under consideration within each of the five sections may be combined with any alignment in the adjacent sections.

Each alignment has distinctive characteristics, environmental impacts, and provides different service options. Therefore, each alignment will be evaluated individually and compared to the other alignments in each section. The sections that will be evaluated and the alignments being evaluated for each section are listed in Table 1-1.

Table 1-1. Fixed Guideway Alternative Analysis Sections and Alignments

Section	Alignments Being Considered
I. Kapolei to Fort Weaver Road	Kamokila Boulevard/Farrington Highway
	Kapolei Parkway/North-South Road
	Saratoga Avenue/North-South Road
	Geiger Road/Fort Weaver Road
II. Fort Weaver Road to Aloha Stadium	Farrington Highway/Kamehameha Highway
III. Aloha Stadium to Keehi Interchange	Salt Lake Boulevard
	Makai of the Airport Viaduct
	Mauka of the Airport Viaduct
	Aolele Street
IV. Keehi Interchange to Iwilei	North King Street
	Dillingham Boulevard
V. Iwilei to UH Manoa	Hotel Street/Kawaiahao Street/Kapiolani Boulevard with or without Waikiki Spur
	Hotel Street/Waimanu Street/Kapiolani Boulevard with or without Waikiki Spur
	Nimitz Highway/Queen Street/Kapiolani Boulevard with or without Waikiki Spur
	Nimitz Highway/Halekauwila Street/Kapiolani Boulevard with or without Waikiki Spur
	Beretania Street/South King Street
	Waikiki Spur

Project Purpose

The purpose of the Honolulu High-Capacity Transit Corridor Project is to provide improved mobility for persons traveling in the highly congested east-west transportation corridor between Kapolei and the University of Hawaii at Manoa (UH Manoa), confined by the Waianae and Koolau Mountain Ranges to the north and the Pacific Ocean to the south. The project would provide faster, more reliable public transportation services in the corridor than those currently operating in mixed-flow traffic. The project would also provide an alternative to private automobile travel and improve linkages between Kapolei, the urban core, UH Manoa, Waikiki, and the urban areas in between. Implementation of the project, in conjunction with other improvements included in the Oahu Regional Transportation Plan (ORTP), would moderate anticipated traffic congestion in the corridor. The project also supports the goals of the Oahu General Plan and the ORTP by serving areas designated for urban growth.

Project Area Needs

Improved mobility for travelers facing increasingly severe traffic congestion.

The existing transportation infrastructure in this corridor is overburdened handling current levels of travel demand. Motorists experience substantial traffic congestion and delay at most times of the day during both the weekdays and weekends. Transit is caught in the same congestion. Travelers on Oahu's roadways currently experience 42,000 daily vehicle-hours of delay, which is projected to increase over seven-fold to 326,000 daily vehicle-hours of delay by 2030. Current morning peak-period travel times for motorists from Kapolei to downtown average between 40 and 60 minutes, while recent observations of bus travel times from Ewa Beach to downtown ranged from 30 to 80 minutes depending on traffic conditions. By 2030, these travel times are projected to more than double. Within the urban core, most major arterial streets will experience increasing peak period congestion, including Ala Moana Boulevard, Dillingham Boulevard, Kalakaua Avenue, Kapiolani Boulevard, King Street and Nimitz Highway. Expansion of the roadway system between Kapolei and UH Manoa is constrained by physical barriers and by dense urban neighborhoods that abut many existing roadways. Given the current and increasing levels of congestion, a need exists to offer an alternative way to move within the corridor independent from current and projected highway congestion.

Improved transportation system reliability.

As roadways become more congested, they become more susceptible to substantial delays caused by incidents such as traffic accidents or heavy rain. Because of the operating conditions in the study corridor, current travel times are not reliable for either transit or automobile trips. In order to get to their destination on time, travelers have to allow extra time in their schedules to account for the uncertainty of travel time. This is inefficient and results in lost productivity. Because the bus system primarily operates in mixed-traffic, transit users experience the same level of travel time uncertainty as automobile drivers. Recent statistics from TheBus indicate that on a systemwide basis, for all classes of bus routes, 45 percent of buses were on time, 27 percent were more than five minutes late and 28 percent more than one minute early. In the morning peak period, express buses were on time 27 percent of the time, with 38 percent being late and 35 percent being early. A need exists to reduce the variability of transit travel times, and provide a system with increased predictability and reliability.

Accessibility to new development in Ewa/Kapolei/Makakilo as a way of supporting policy to develop the area as a second urban center.

Consistent with the General Plan for the City and County of Honolulu, the highest population growth rates for the island are projected in the Ewa Development Plan area (comprised of the Ewa, Kapolei and Makakilo communities) which is expected to grow by 170 percent between years 2000 and 2030. This growth represents nearly 50 percent of the total growth projected for the entire island. Within this area, Kapolei, which is developing as a "second city" to downtown Honolulu, is projected to grow by 426 percent, the Ewa neighborhood by 123 percent and Makakilo by 94 percent between years 2000 and 2030. Accessibility to the overall Ewa Development Plan area is currently severely impaired by the congested roadway network, which will only get worse in the future. This area is less likely to develop as planned unless it is accessible to downtown and other parts of Oahu; therefore, the Ewa/Kapolei/ Makakilo area needs improved accessibility to support its future growth as planned.

Improved transportation equity for all travelers.

Many lower-income and minority workers live in the corridor outside of the urban core and commute to work in the Primary Urban Center Development Plan Area. Many lower-income workers also rely on transit because they are not able to afford the cost of vehicle ownership and operation. In addition, daily parking costs in downtown Honolulu are among the highest in the United States, further limiting this population's access to the downtown. Improvements to transit capacity and reliability will serve all transportation system users, including low-income and under-represented populations.

Project Schedule

Projects developed through the FTA *New Starts* process progress through many stages from system planning to operation of the project. The Honolulu High-Capacity Transit Corridor Project is currently in the Alternatives Analysis phase, which includes defining and evaluating specific projects to address the purpose of and needs for the project discussed earlier in this chapter. The anticipated project development schedule is shown in Figure 1-3.

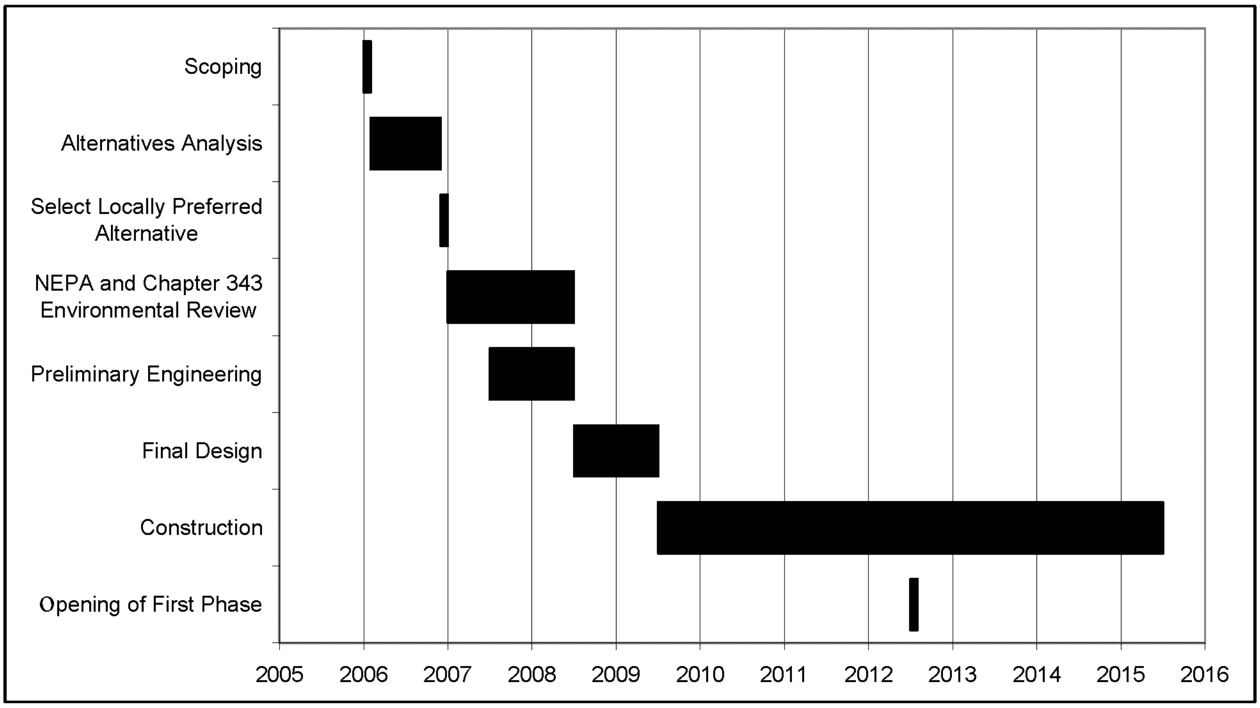


Figure 1-3. Project Schedule

Chapter 2 Project Delivery Environment

This chapter describes project delivery or procurement concepts and the issues that impact or are impacted by the project delivery option. The chapter begins with a discussion of the project elements to be delivered by the contractor. This is followed by a high-level comparison of the primary types of project delivery. Specific considerations of project technology and phasing are discussed. Finally, different types of project financing are presented.

Project delivery concepts describe at a high level the way that the project work elements are packaged and delivered contractually. These concepts are then defined at a greater level of detail as project delivery options. The goal the project delivery evaluation is to determine the delivery option that allocates risk to the party best able to manage that risk. Factors that influence the alignment of risk and risk management include the scale (cost) of the project, the project financing, and phasing considerations.

Project Elements to be Delivered

The project to be delivered as part of the HHCT is comprised of a number of sub-elements that together provide an integrated operating transit system. A primary differentiator in project delivery options is how the sub-elements are grouped together for procurement. For a fixed guideway system, these sub-elements can be grouped into two primary categories: Fixed Facilities and Operating System.

The Fixed Facilities are the buildings, structures and civil works associated with and in support of the transportation system. Fixed Facility sub-elements include:

- Guideway - at-grade, elevated, or tunnel.
- Stations - platforms, equipment rooms, vertical circulation, parking, and roadways.
- Wayside Structures – substation buildings/enclosures, noise barriers, security barriers.
- Maintenance Facility – building, yard/shop guideway, parking and roadways.

The Operating System includes all of the mechanical and electrical equipment that comprise the electro-mechanical system that performs the transportation function. Operating System sub-elements include:

- Vehicles – revenue service and spares.
- Train control – signals and communications.
- Traction Power – transformers, rectifiers, and distribution.

- Station Equipment – dynamic signs, public address, surveillance, and automatic doors, if included.

- Guideway Equipment – rails/running surfaces, switches, walkways, and lighting.

- Fare collection – fare media dispensers and gates/turnstiles.

- Maintenance Equipment – tools, spare parts, and maintenance vehicles.

Project Delivery Basic Concepts

There are two primary types of project delivery methods: Conventional (Design-Bid-Build) and Design-Build.

Conventional Method

The Conventional method is the most common method used in recent history for delivering transit projects in the United States. From the early 1900s until about 25 years ago, it was the only method used by public agencies to procure transit systems. The project owner is responsible for developing the overall concept, including the planning and alternatives analysis, and the final design for all sub-elements to be delivered under this method. The designs are then put out for bid by construction contractors.

Once the contractor, or contractors (depending upon how the sub-elements are packaged), are selected, the project owner is responsible for managing and overseeing all aspects of the project. This includes managing the interfaces between the sub-elements that have been grouped under separate delivery packages and ensuring the project is constructed according to the design and specifications.

Design-Build Method

The Design-Build method is being used increasingly in the United States and throughout the world. The project sponsor is still responsible for developing the overall concept, including the planning and alternatives analysis, however, designs are taken only to a conceptual level, such as 10 or 15 percent design for the sub-elements to be procured under the Design-Build method. The project owner then uses this information to develop performance specifications and solicits proposals from contractors. In this case, the contractors are responsible for completing the designs, based on fulfilling the performance requirements.

The contractor is also responsible for managing the project and interfaces for all sub-elements included in the Design-Build contract. In addition, the contractor must certify that the project as constructed meets the requirements of the performance specifications as well as all statutory requirements. Development of this certification process is a key element of a Design-Build contract. The project owner must still oversee the project to be sure the contractor is fulfilling their obligations according to the performance specifications.

The reason for a project Owner to use Design-Build is that it may not be familiar with all of the technical requirements of the project; it may not have sufficient staff to effectively manage the project. With Design-Build, the project owner manages the institutional and public risks, while the contractor manages the project's technical, schedule and costs risks.

Project Technology Considerations

A full range of potential transit technologies were considered and evaluated in a two-level screening process. This technology evaluation was documented in the Final Transit Technology Screening and Assessment Technical Report dated April 27, 2006. For the Managed Lane Alternative, conventional buses (single unit and articulated) and guided bus were retained for further consideration. For the Fixed Guideway Alternative, the technologies retained included Light Rail Transit (LRT) People Movers, Monorail, Maglev and Rapid Rail Transit (RRT). The City has expressed the desire not to select a specific technology but to have the remaining technologies compete against each other.

Technology considerations impact the project delivery decision given the varying degree of proprietary design of different technologies. At "Full-proprietary" end of the range are technologies whose design is both proprietary and integral to the guideway structure, such as Maglev and Monorail. For these technologies, both the operating system and a portion of the guideway structure are unique to specific suppliers. These technologies are delivered through a Design-Build type of procurement in which the system supplier delivers its "package" of integrated systems.

In the middle of the "proprietary" range are automated People Movers and automated Rapid Rail whose operating system equipment is proprietary but the guideway structure is not. The operating system for these technologies is also delivered through some form of Design-Build (as opposed to Design-Bid-Build) in which the system supplier delivers an integrated "package" of subsystems.

At the opposite end of the proprietary range is LRT and HRT whose operating system and guideway structure are not proprietary; for example, different LRT supplier vehicles can operate over the same running surface (rails). Non-proprietary technologies are typically delivered through the Design-Bid-Build method.

Project Phasing Considerations

The Owner may lose pricing leverage for future phase of a proprietary technology system. The length of time between phases, the "extent" of the proprietary design and the division of the contractor all determine the image of this future pricing leverage. The choice of the type of project delivery option can also be affected by the desired implementation phasing of the overall project. If the timing between an initial and final phase are close enough, for example within three years, then the initial contractor bids/prices would include subsequent phase pricing and hence a single contractor can be selected for both (all) phases of a project.

Current phasing plans for the HHCT project envisions an initial phase at the western (Kapolei to Waipaki) end of the corridor followed approximately two years later by a second phase connecting the initial alignment to Downtown area and possibly all the way to UH Manoa (completing the line). If the second phase does not reach UH Manoa then a third phase would do so some years in the future.

The project delivery method can vary by project phase. Different phase length and alignment environment ("green field" vs. developed urban) can change the relative priorities of the evaluation criteria so that the best delivery option for the initial phase may be different than the best option for a latter phase. This will be considered in the initial screening performed in Chapter 3 of the report.

Project Financing Options

The type of financing strategy used to fund the project can affect the choice of a project delivery option and vice versa. The two aspects of the project should be considered together to develop the optimum overall procurement approach. The four basic types of financing for this type of project include government financing, concession, franchise, and public-private partnership. Government financing, both local and federal appears to be the favored project financing option with possible public-private partnership financing of a small element(s) of the project. For these two financing options, the type of project delivery method would not be a differentiator.

Owner's Desired Level of Design Contract and Project Risks

In deciding between Design-Bid-Build and the various Design-Build delivery options, an important issue is the project owner's (City and County of Honolulu) existing organizational structure and activities the City wants to perform in-house. These activities include project management, design, construction supervision, community outreach, agency coordination, land acquisition, and other services not directly involving construction, manufacturing or installation.

The activities that the City wants to perform in-house, either with consultants or its own staff, is a function of its desired level of design control and of project risk. The level of project owner's design control and project risk are critical issues in determining the most appropriate project delivery option as the different options allocate design control and risk quite differently. The project delivery options that survive the initial screening will then be defined in terms of design control and project risk.

Chapter 3 Initial Delivery Options and Screening

This chapter describes the types of project delivery options applicable to the HHCT project and performs an initial screening. The project delivery options that remain following the initial screening are then defined in terms of design control and risk. The initial delivery options are described in terms of responsibilities and packaging of the various sub-elements of a transit system through a normal sequence of project activities. These activities are:

1. Planning and Alternatives Analysis.
2. Procurement and Contractor Selection
3. Design – preliminary through final design in terms of percent complete.
4. Manufacture and Construction.
5. Integration Testing and Demonstration.
6. Operations.
7. Maintenance.

The sub-elements of a transit system relate to the discussion in Chapter 2 on project elements to be delivered. For the Operating System, the sub-elements include vehicles, signals (train control), traction power, station equipment, guideway equipment and fare collection equipment. For the Fixed Facilities, the sub-elements include guideway (structure, architecture, bridges/tunnels), station structure, station architecture, geotechnical and utility relocation.

The project methods primarily vary by how activities 3, 4, 5, 6 and 7 are packaged and the primary party responsible. One conventional Method and four basic Design-Build methods are described in the text and presented graphically.

These five options present a wide range of ways in which a project can be delivered. This is not intended to be an all-inclusive list of project delivery options but it is expected that the eventual preferred deliver option would be one of these five or a slightly modified version of one of them.

Conventional Method

Design-Bid-Build

As discussed in the previous chapter, in Design Bid Build (DBB) the owner takes responsibility for managing the planning, design, and implementation of the project, including the integration of all the project's sub-elements into a final product. The owner designs the system and the contractor builds it. The owner contracts with a design firm to provide detailed design documents. Fixed price bids are then solicited from contractors to perform the work. The contractor (s) is usually selected on the basis of lowest price. The owner and its consultants assume much of the technical and all of the integration risks for the fixed facilities and operating system.

Table 3-1graphically depicts the DBB delivery option with sequential project activities (top to bottom) along the vertical axis and different project sub-elements along the horizontal axis.

Table 3-1. Design Bid Build Responsibilities

			OPERATING SYSTEM							FACILITIES									PROJECT		
			Vehicles	Signals/ Train Controls	Traction Power	Station Equip't	Track/ Guideway	Guideway Equip't	Fare Collection	Guideway Structure	Guideway Architect	Long-Span Bridges	Tunnels	Station/ Facilities Structure	Station/ Facilities Architect	Geotech	Utility Relocate	Project Mgmt	Project Oversight	Gov't/ Commun. Relations
PROJECT ACTIVITIES	Planning/ Alternative Analysis																			
	Procurement/ Contractor Selection												CITY/CONSULTANT TEAM							
	Design	10%																		
		25%																		
		50%																		
		75%																		
		100%																		
	Manufacture/ Construction				SYSTEM SUPPLIERS							FACILITIES CONTRACTOR								
	Integration Testing/ Demonstration										SHARED									
	Operation																			
	Maintenance																			

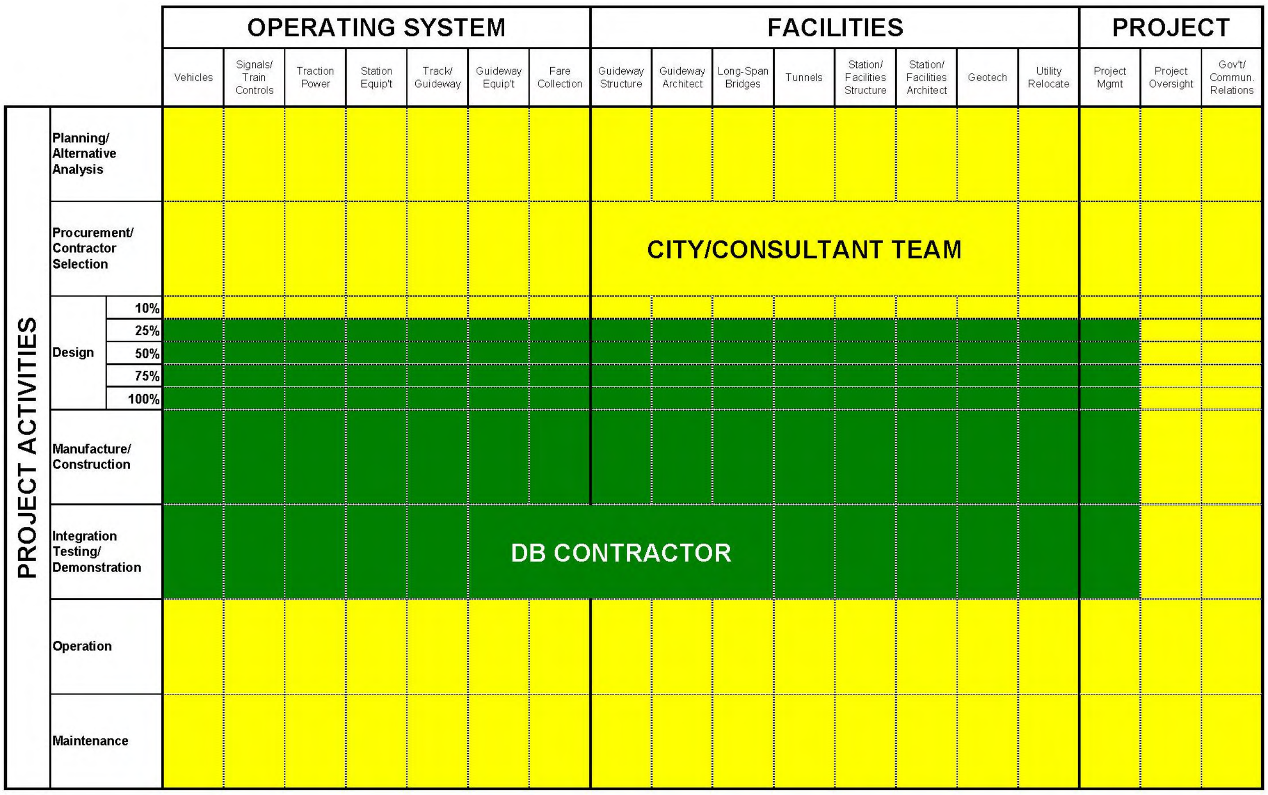
Examples of the DBB are plentiful and it is the dominate delivery option for non-proprietary technologies such as LRT and RRT. Light Rail Systems in Denver, Los Angeles and Seattle as well as the San Francisco Rapid Rail system are all examples of Design-Bid-Build.

Design-Build Methods

Design Build

In the Design Build (DB) delivery option, the owner enters into one contract for the delivery of a complete, functioning system. Design Build is often referred to as "Turnkey". The owner or a third party will operate and maintain the transit system once it is built. The owner must create a contract with a well-defined work scope, performance specifications and schedule, and the owner relinquishes significant control and risk over project design. The single contractor is responsible for optimizing inter-relationships between the operating system and the fixed facilities as well as most schedule risk. Table 3-2 graphically depicts the DB delivery option.

Table 3-2. Design Build Responsibilities

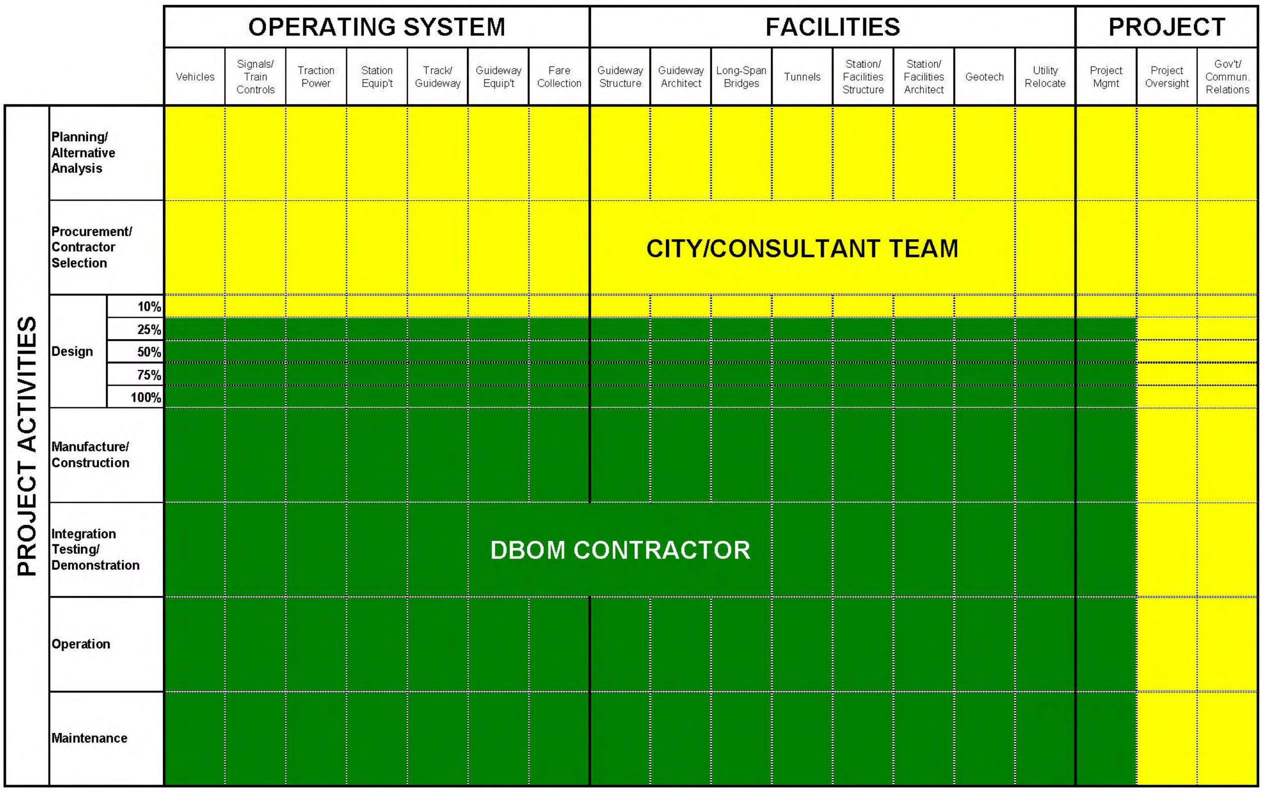


Examples of DB project delivery are less prevalent historically than Design-Bid-Build for fixed rail transit but recent applications include the Portland MAX Airport Light (Light Rail), the Vancouver Expo Line (automated Rapid Rail), and the Washington Metro Dulles Corridor (Rapid Rail).

Design Build Operate Maintain

The Design Build Operate Maintain (DBOM) delivery option is similar to the DB option in that the project owner enters into one contract for the delivery of a complete, functioning system that will be operated and maintained by the system supplier. The owner must develop the concept and then create a contract with a well-defined work scope, performance specifications and schedule. The single contractor assumes the technical and integration risks for and between the operating system and fixed facilities as well as most schedule risk. The owner relinquishes significant control (and risk) over the facility and system design. The DBOM delivery option is provided in Table 3-3 below.

Table 3-3. Design Build Operate Maintain Responsibilities

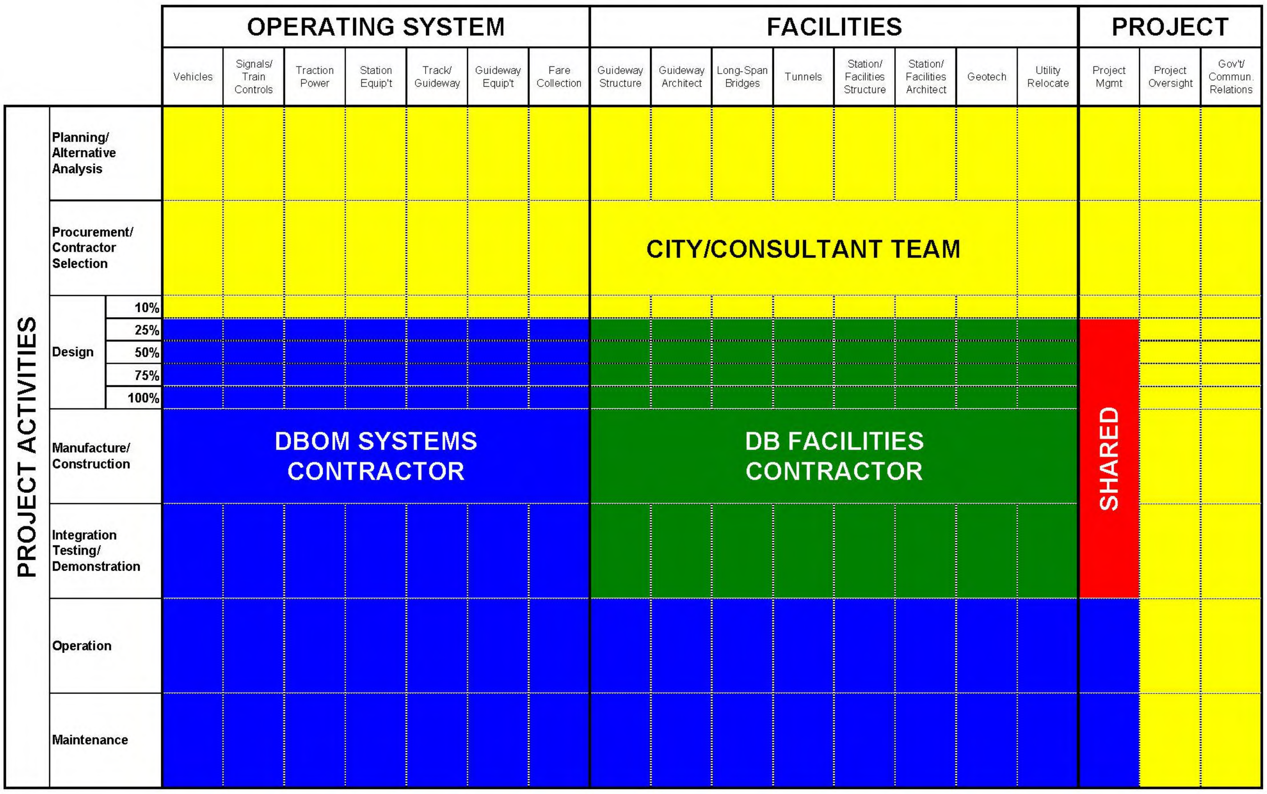


Examples of DBOM while dominant for smaller applications (i.e., Airports) of People Movers and Monorails are less prevalent for longer urban transit applications such as the HHCT project. Urban examples of DBOM do include the New Jersey Hudson Bergen (Light Rail), the Vancouver Canada Line (automated Rapid Rail), the 1992 Honolulu Transit Project (automated Rapid Rail technology selected but project cancelled) and the Las Vegas Monorail (Monorail).

Split Design Build Operate Maintain and Design Build

With Split DBOM - DB, the transit operating system (vehicles and other equipment) and the fixed facilities are separated into two contracts. One is a DBOM contract for the operating system and the other is a DB contract for the fixed facilities. The owner must create contracts with a well-defined work scope, performance specifications and schedule, and the owner relinquishes significant control and risk over project design. The owner is responsible for interface coordination where work between the two contracts "meets" and is responsible for the management of all contracts. The Split DBOM-DB delivery option is provided in Table 3-4 below.

Table 3-4. Split DBOM and DB Responsibilities

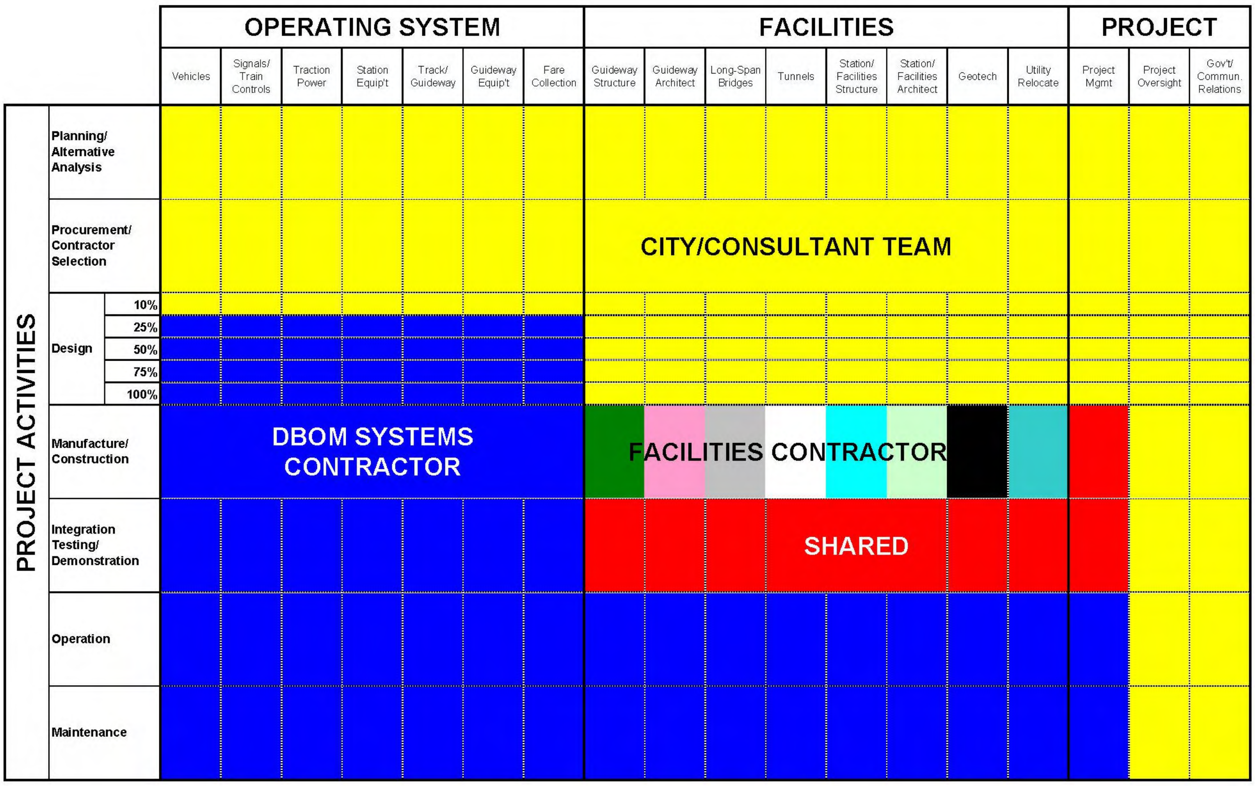


Examples of the Split DBOM (system) and DB (facilities) include the Vancouver Millennium Line (automated Rapid Rail) and the San Juan Tren Urbano (Rapid Rail).

Split Design Build Operate Maintain and Design Bid Build

With Split DBOM - DBB, the transit operating system is a single DBOM contract and the fixed facilities are separated into multiple DBB contracts. The owner relinquishes significant control and risk over systems design but maintains control and risk over the facilities design. The owner is responsible for interface coordination where work between the contracts "meets" and is responsible for the management of all contracts. The Split DBOM-DBB delivery option is shown in Table 3-5 below.

Table 3-5. Split DBOM and DBB Responsibilities



Examples of Split DBOM and DBB include Kuala Lumpur (ART – 19 miles) and the current Las Vegas Monorail extension (8 miles).

Initial Screening of Delivery Options

As described in the previous section, the five delivery options provide a wide array of ways in which a transit project can be procured. The list is not intended to be all inclusive ways a project can be delivered. As each can be alternated slightly and, in fact, fixed guideway transit projects have historically customized as local project-specific considerations and staff preferences dictate. The five delivery options are initially screened against a number of criteria. The results of this screening are provided in Table 3-6 below.

Applicability to Remaining Technologies

The five delivery options initially identified are applicable to one or more of the transit technologies still under consideration by the City as detailed in the DTS Technology Options (*Transit Technology Screening and Assessment Technical Report)*. The technologies retained for further consideration for fixed guideway alternatives included Light Rail Vehicle, People Mover, Monorail, Maglev and Rapid Rail Transit.

Applicability to HHCT Project Size

A transit project's size, measured in terms of physical length or cost, has been seen to impact a single contractor (DB and/or DBOM options) team's ability to obtain sufficient bonding and insurance. Projects with costs exceeding one billion dollars have experienced this issue where the facility contractor (typically the prime contractor) has trouble obtaining cost effective bonding/insurance due to the fact that a team subcontractor (system provider) has the highest risks in terms of integration and schedule adherence. This issue arose at the Las Vegas Monorail system opening and the cancelled Seattle Monorail project. For smaller projects, the DB and DBOM delivery options have been successfully applied numerous times. Separating the facilities contractor from the systems contract or, whether through Design-Bid-Build (multiple systems and facilities contractor) or through a "split" delivery option (DBOM system and DB or DBB facilities) removes this problem. Therefore, it is recommended that the Design-Build (Option 2) and the Design-Build-Operate-Maintain (Option 3) be eliminated from further consideration.

Applicability to Potential Phasing

A potential phasing plan for the HHCT project has an initial phase at the western (Kapolei to Waipaki) end of the corridor. Minimizing the design and construction durations is given a very high priority under this plan. The relatively small size of the phase (as discussed in the section above) and the emphasis on minimizing project schedule both favor a Design-Build project delivery approach. This would not preclude the City from using a more appropriate delivery option for the larger subsequent phases of the project.

Initial Screening Findings

The findings of this initial screening are presented in Table 3-6 below. While the Design-Build delivery option is considered most appropriate for an initial phase, only three of the original five options are recommended for a detailed evaluation in the context of a single large project or larger phases. These three options are Design-Bid Build, Split DBOM/DB and Split DBOM/DBB.

Table 3-6. Project Delivery Initial Screening

	DBB	DB	DBOM	Split DBOM DB	Split DBOM DBB
	1	2	3	4	5
Initial Screening Criteria					
Technologies	✓	✓	✓	✓	✓
Large Project / Phase	✓	✗	✗	✓	✓
Small Initial Phase	✗	**✓**	✓	✗	✗

Key: **✓** = most appropriate ✗ = inappropriate

✓ = appropriate NA = not applicable

Design Control and Project Risks for Remaining Options

As described in Chapter 2, the assignment of design control and project risk varies greatly among the range of project delivery options initially considered. This remains true for the three options remaining after the initial screening. A breakdown of how each of the delivery options assigns control and risk in provided in Table 3-7 below.

Table 3-7. Assignment of Control and Risk

	DBB	**Split DBOM-System DB-Facilities**	**Split DBOM-System DBB-Facilities**
Control			
System Performance Reqts.	City	City	City
System Detail Design	City	System Contractor	System Contractor
System Design Changes	Shared	System Contractor	System Contractor
Facilities Design Criteria	City	City	City
Facilities Detailed Design	City	Facilities Contractor	City
Facilities Design Changes	Shared	Facilities Contractor	Shared
Local/Design/Contracting	City	Facilities Contractor	City
Service Level Requirements	City	City	City
Changes to Service Level	City	System Contractor	System Contractor
Risks			
Capital Costs – Systems	Shared	System Contractor	System Contractor
Capital Costs - Facilities	Shared	Facilities Contractor	Shared
Inflation	City	Contractors	Shared
Operating Costs	City	System Contractor	System Contractor
Operating Revenues	City	City	City
Capital Program Schedule	Shared	Contractors	Shared
System Performance	City	System Contractor	System Contractor
Subsystem Performance	Subsystem Contractor	System Contractor	System Contractor
Subsystem Interfaces	City	Contractors	System Contractor
Geotechnical	City	Facilities Contractor	City
Utilities	City	Facilities Contractor	City
Stakeholder	City	City	City

Chapter 4 Project Delivery Option Evaluation

This chapter describes the evaluation of the remaining three project delivery options listed in the previous section for larger or multiple phases. This evaluation is based on assessing each option's suitability as considered against a set of project specific evaluation criteria. These criteria were developed in discussions with the client as well as the relative importance of each of the criterion.

Delivery Option Evaluation Criteria

The delivery option evaluation criteria developed with the City officials are described below.

- Technology Issues - The degree of contractor innovation fostered by a delivery option and the future availability of supplier support given a delivery option.
- Project Cost – The degree to which project cost is impacted by a delivery option. These include capital costs for the operating system and facilities for initial and latter phases, for operations/maintenance costs, and for "safe" or development costs incurred by the City.
- Schedule - The degree to which project schedule is impacted by the delivery option. This includes the time to select a project contractor(s), time to begin construction, and time to achieve system opening.
- City Risk – The assignment of management and technical Project risks to the entity best able to manage those risks. Risks include cost/price escalation, design, subsystem integration and system performance (capacity, travel time, availability, safety, etc.). The ability to manage the cost and schedule impacts of unknown subsurface conditions including geotechnical conditions and utility relocation. The criterion also addresses risk regarding the interface between the project and the power and communications utilities.
- City Control – the degree of control over the final design and appearance of sub-elements. This can include station/guideway architecture, vehicle aesthetics, phasing of specific construction activities.
- Local Contracting Opportunities – The ability of local businesses to obtain work related to the design, manufacture and construction of the project. The ability of local businesses to obtain work related to the operation and/or maintenance of the system and its facilities. The degree to which a delivery option fosters competition among supplier teams.
- Private/Public Partnership – the degree to which a project delivery option accommodates a public/private partnership as a means of enabling the project to capture more of the value that it creates. Value capture may include joint development of station or alignment air rights, station and dynamic advertisement and the leasing of retail/commercial space in station facilities.

The results of this screening process can be used as input and considerations in assessing and selecting financing strategies and transit technologies. In the end, however, financing, project delivery options and, to a lesser extent, transit technology type, must all be considered together to determine the optimum procurement approach for the HHCT project.

Delivery Option Evaluation

The five project delivery options were evaluated against the evaluation criteria described above. Project funding was assumed to be generally provided by local and federal government. Three separate project delivery option evaluations were performed against three different "types" of transit technology, due to the varying degree of a transit technology's proprietary design and its impact on certain evaluation criteria.

All fixed guideway technologies have some level of proprietary design. For the purpose of this report, the technologies remaining from the earlier technology screening have been classified as non-proprietary, semi-proprietary or full-proprietary.

Evaluation criterion priority ranges between low, moderate, high and very high, and is based on discussions with DTS staff. Evaluation results range from a low grade of "Fail" to a high grade of "Excellent". Evaluation results are provided in Tables 4.1 through 4.3 on the following pages.

Table 4-1. Project Deliver Option Evaluation for Non-Proprietary Technologies[1]

PROJECT DELIVERY EVALUATION CRITERIA	Relative Weight	Project Delivery Options		
		Design-Bid-Build	Split DBOM Syst DB Facil	Split DBOM Syst DBB Facil
Technology Issues	**5%**			
- Innovation	25%	◑	◕	◕
- Future Availability	75%	●	●	●
Costs	**20%**			
- Initial Phase System	10%	◑	◕	◕
- Initial Phase Facility	30%	◕	◕	◕
- Ops & Maint	10%	◑	◑	◑
- Latter Phase System	15%	●	●	●
- Latter Phase Facility	20%	●	●	●
- Soft Costs	15%	◑	◑	◑
Schedule	**20%**			
- Select Contractor	30%	◑	◕	◑
- Begin Construction	30%	◑	◕	◑
- Begin Operations	20%	◑	◑	◑
- Latter Phasing	20%	◑	◑	◑
City Risk	**10%**			
- Cost	17%	◑	●	◕
- Revenue	17%	●	●	●
- Schedule	17%	◑	●	◑
- Performance	17%	◔	◕	◕
- Integration	17%	◔	●	●
- Subsurface Conditions	17%	◑	◕	◑
City Control	**15%**			
- Design of Op. System	20%	◕	◔	◔
- Design of Facil. Stations	30%	◕	◔	◕
- Design of Facil. Gdwy Struct.	25%	◕	◔	◕
- Local Design/Contract Partic.	15%	●	◔	●
- Changes to Service Level	10%	●	◔	◔
Local Contracting	**25%**			
- Design/Manuf. Systems	30%	◕	◔	◔
- Design/Manuf. Facilities	60%	●	◔	●
- Ops / Maint	10%	◕	◑	◑
Public/Private Partnership	**5%**			
- Facilities Value Capture	100%	◑	◑	◑
TOTAL SCORE	**100%**	**72**	**54**	**68**

Legend: ● = Excellent ◕ = Good ◑ = Moderate ◔ = Poor ○ = Fail

[1]Note: All fixed guideway technologies have some level of proprietary design. "Non-proprietary" technologies in this table refer to Light Rail Transit and Rapid Rail Transit as defined in the DTS report, *Transit Technology Screening and Assessment Technical Report.*

Table 4-2. Project Deliver Option Evaluation for Semi-Proprietary Technologies[1]

PROJECT DELIVERY EVALUATION CRITERIA	Relative Weight	Project Delivery Options		
		Design-Bid-Build	Split DBOM Syst DB Facil	Split DBOM Syst DBB Facil
Technology Issues	**5%**	NA		
- Innovation	25%		●	●
- Future Availability	75%		◕	◕
Costs	**20%**	NA		
- Initial Phase System	10%		◕	◕
- Initial Phase Facility	30%		◕	◕
- Ops & Maint	10%		◑	◑
- Latter Phase System	15%		◑	◑
- Latter Phase Facility	20%		◑	●
- Soft Costs	15%		◑	◑
Schedule	**20%**	NA		
- Select Contractor	30%		◕	◑
- Begin Construction	30%		◕	◑
- Begin Operations	20%		◑	◑
- Latter Phasing	20%		◑	◑
City Risk	**10%**	NA		
- Cost	17%		●	◕
- Revenue	17%		●	●
- Schedule	17%		●	◑
- Performance	17%		◕	◕
- Integration	17%		●	●
- Subsurface Conditions	17%		◕	◑
City Control	**15%**	NA		
- Design of Op. System	20%		◔	◔
- Design of Facil. Stations	30%		◔	◕
- Design of Facil. Gdwy Struct.	25%		◔	◕
- Local Design/Contract Partic.	15%		◔	●
- Changes to Service Level	10%		◔	◔
Local Contracting	**25%**	NA		
- Design/Manuf. Systems	30%		◔	◔
- Design/Manuf. Facilities	60%		◔	●
- Ops / Maint	10%		◑	◑
Public/Private Partnership	**5%**	NA		
- Facilities Value Capture	100%		◑	◑
TOTAL SCORE	**100%**	NA	**50**	**66**

Legend: ● = Excellent ◕ = Good ◑ = Moderate ◔ = Poor ○ = Fail

[1] Note: All fixed guideway technologies have some level of proprietary design. "Semi-proprietary" technologies in this table refer to People Mover and Rapid Rail.

Table 4-3. Project Deliver Option Evaluation for Full-Proprietary Technologies[1]

PROJECT DELIVERY EVALUATION CRITERIA	Relative Weight	Project Delivery Options		
		Design-Bid-Build	Split DBOM Syst DB Facil	Split DBOM Syst DBB Facil
Technology Issues	**5%**	NA		
- Innovation	25%		●	●
- Future Availability	75%		◑	◑
Costs	**20%**	NA		
- Initial Phase System	10%		◕	◕
- Initial Phase Facility	30%		◕	◕
- Ops & Maint	10%		◑	◑
- Latter Phase System	15%		◔	◔
- Latter Phase Facility	20%		◑	●
- Soft Costs	15%		◑	◑
Schedule	**20%**	NA		
- Select Contractor	30%		◕	◑
- Begin Construction	30%		◕	◑
- Begin Operations	20%		◑	◑
- Latter Phasing	20%		◑	◑
City Risk	**10%**	NA		
- Cost	17%		●	◕
- Revenue	17%		●	●
- Schedule	17%		●	◑
- Performance	17%		◕	◕
- Integration	17%		●	●
- Subsurface Conditions	17%		◕	◑
City Control	**15%**	NA		
- Design of Op. System	20%		◔	◔
- Design of Facil. Stations	30%		◔	◕
- Design of Facil. Gdwy Struct.	25%		◔	◕
- Local Design/Contract Partic.	15%		◔	●
- Changes to Service Level	10%		◔	◔
Local Contracting	**25%**	NA		
- Design/Manuf. Systems	30%		◔	◔
- Design/Manuf. Facilities	60%		◔	●
- Ops / Maint	10%		◑	◑
Public/Private Partnership	**5%**	NA		
- Facilities Value Capture	100%		◑	◑
TOTAL SCORE	**100%**	NA	**48**	**64**

Legend: ● = Excellent ◕ = Good ◑ = Moderate ◔ = Poor ○ = Fail

[1] Note: All fixed guideway technologies have some level of proprietary design. "Full proprietary" technologies in this table refer to Monorail and Maglev.

Project Delivery Evaluation Summary

The findings of the project delivery option evaluation are summarized in the following section. Findings are given at a general level and in specific terms of advantages and disadvantages within the context of a type of transit technology (level of proprietary design). Recommendations focus on whether a delivery option should be retained for consideration in terms of a given type or types of fixed guideway transit technology.

In general terms, the findings from the project delivery evaluation can be summarized as follows:

- No single "right" way to deliver a major transit project has emerged historically.
- No single project delivery option emerges as far superior to the others in this evaluation regardless of the desired transit technology.
- Design-Bid-Build scored highest for non-proprietary technologies (Light Rail and Rapid Rail) followed closely by Split DBOM System and DBB Facilities.
- Split DBOM System and DBB Facilities scored highest for both semi-proprietary (People Movers and automated Rapid Rail) and full-proprietary (Monorail and Maglev). Split DBOM/DBB would be most appropriate if more than one technology were to compete against each other.
- Split DBOM Systems and DB Facilities did not score well, relatively or absolutely, for the transit technologies and is eliminated from further consideration.

If the Design-Bid-Build option is used for the systems, then the technology would have to be decided upon before the project is bid.

The key issue in selecting a delivery option for the HHCT project is to identify the City's desired level of design control and project risks for various aspects of the project. The project delivery option that most closely matches with the City's desired levels of control and risk, and allows for the desired range of technologies, is the most appropriate option.

A potential form of public/private participation in the project is joint development in and around stations. This can be accomplished through any of the three remaining delivery options.

Evaluation Findings for Non-Proprietary Technologies

Design-Bid-Build (DBB)

Advantages – The option scores well in terms of Technology (future availability), Costs (latter phases), City Control, and Local Contracting (design and manufacturing of facilities).

Disadvantages – The option scores poorly in terms of some aspects of City Risks.

Recommendation – DBB scores well overall for non-proprietary technologies, scoring highest among the three delivery options. It is recommended to be kept as a potential delivery option if the City desires to limit the technology range to either Light Rail or Rapid Rail (non-automated).

Split DBOM Systems & DB Facilities

Advantages – The option does well in terms of Technology (future availability), Costs (latter phases) and City Risks.

Disadvantages – The option does poorly in terms of City Control and Local Contracting.

Recommendation – The Split DBOM/DB scores only moderately overall for non-proprietary technologies, scoring lowest among the three delivery options. Therefore, it is recommended to be dropped as a potential delivery option if the City desires Light Rail or Rapid Rail (non-automated).

Split DBOM System & DBB Facilities

Advantages – This option does well in terms of Technology (future availability), Costs (latter phases), some aspects of City Risk, City Control and Local Contracting.

Disadvantages – The option scores poorly in terms of some aspects of City Control and Local Contracting.

Recommendation – The Spilt DBOM/DBB scores well overall for non-proprietary technologies, scoring a close second to DBB. Therefore, it is recommended to be kept as a potential delivery option if the City desires Light Rail or Rapid Rail (non-automated).

Evaluation Findings for Semi- and Full-Proprietary Technologies

Design-Bid-Build (DBB) - This project delivery option is not applicable to the operating system of either semi-proprietary or full-proprietary technologies and was therefore not evaluated against the two other delivery options.

Split DBOM Systems & DB Facilities

Advantages – The option scores well in terms of Technology (innovation and City Risk.

Disadvantages – The option does poorly in terms of Cost (latter phase system costs), all aspects of City Control, and Local Contracting.

Recommendation – The Split DBOM/DB delivery option scores only moderately overall for the semi- and full-proprietary technologies and scored lowest among the two applicable options. It is recommended to be dropped as a potential delivery option if the City desires People Mover, Rapid Rail (automated), Monorail and/or Maglev.

Split DBOM System & DBB Facilities

Advantages - The option does well in terms of Technology (innovation), some aspects of City Risk and Control, and Local Contracting (facilities).

Disadvantages - The option does poorly in terms of Costs (latter phase systems), and City Control (operating system and changes to service level).

Recommendation – Split DBOM/DBB scores well overall and scores highest among the two applicable delivery options. It is recommended to be kept as the best delivery option as the City has expressed a desire for a range of technologies to compete against one another including Light Rail, People Mover, Rapid Rail (automated), Monorail and Maglev.

References

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